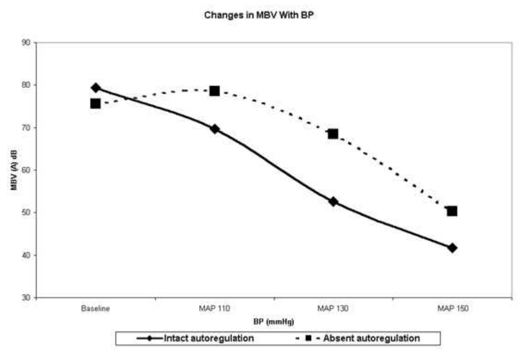
capillary derecruitment occurs to a greater extent than when AR is absent. When AR fails, changes in the degree of capillary derecruitment occur in an attempt to preserve MBV.

	Intact Autoregulation			Absent Autoregulation		
	Heart Rate	BP	MBV	Heart Rate	BP	MBV
Baseline	120.4 ± 15.7	91.89 ± 18.3	79.31 ± 18.2	126 ± 16.8	80 ± 19.5	75.59 ± 20.2
MAP 110	112.6 ± 16.0	110	69.75 ± 11.8	110.3 ± 13.7	110	78.53 ± 11.6
MAP 130	110.4 ± 14.0	130	52.55 ± 17.0*	109.1 ± 16.5	130	68.49 ± 11.4^
MAP 150	110.2 ± 16.0	150	41.69 ± 15.7*	111.3 ± 33.7	150	50.32 ± 20.4*

- *: P <0.05, Compared to baseline autoregulation state.
- ^: P <0.05, Compared to intact autoregulation at same MAP.



1017-160 Noninvasive Vessel-Selective Perfusion Imaging With Intravenous Myocardial Contrast Echocardiography

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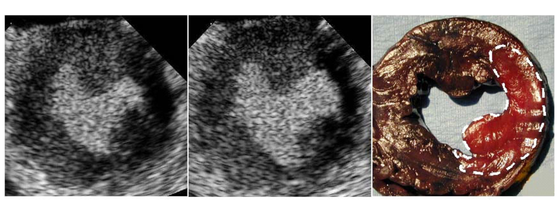
Background: Intravenous myocardial contrast echocardiography (IV-MCE) cannot identify each perfusion area of coronary vessels separately. During IV-MCE, however, by destroying microbubbles passing through specific vessels with high power ultrasound, vessel-selective perfusion imaging (SPI) could be feasible.
Methods: In 8 open-chest dogs, short-axis images were obtained every 8 cardiac cycles during Definity continuous infusion using Sequoia 512. For SPI, an S3 probe coupled to Sonos 5500 was placed on a proximal left circumflex coronary artery (LCx). High power pulses (mechanical index = 0.9 to 1.6) were insonated at 200-ms intervals to destroy bubbles passing through LCx. A contrast defect (LCx-SPI) was planimeterd as LCx perfusion area derived from SPI. After stopping the insonation to LCx, contrast defect area during mechanical LCx occlusion (LCx-occ) and nondyed area by Evans blue with LCx occlusion (LCx-EB) were measured. Each area was expressed as a percentage of the area of the left ventricular myocardium.
Results: In all cases, contrast defects appeared during high power insonation to LCx , and they disappeared when the power decreased. LCx-SPI was an exact territory of LCx, because it showed significant correlation with LCx-occ (r = 0.93) and LCx-EB (r = 0.92).
Conclusion: Vessel-selective perfusion imaging was feasible with IV-MCE by selected bubble destruction. This novel technique has a potential for noninvasive assessment of the coronary bypass graft and collateral perfusion.



LCx – SPI (39.8 %) LCx – OCC (35.7 %) LCx – EB (37.1 %)

1017-161 Measurement of Myocardial Blood Volume and Flow Velocity in Capillaries and Arterioles in the Myocardium by Myocardial Contrast Echocardiography: Dependency on Its Measurement Unit of Backscatter

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Background and Purpose: It has been revealed that parameters of the replenishment curve obtained by myocardial contrast echocardiography (MCE) reflect the regional myocardial blood volume and flow velocity. Moreover, MCE could show arterioles or capillaries of the coronary vessel separately, by adjusting the mechanical index (MI). Recently, it was reported that number of bubbles could be represented by square of acoustic unit (AU^2) with linear relationship, but not by decibel (dB). The purpose of this study was to demonstrate difference of estimated myocardial blood volume and flow velocity by applying dB or AU^2 for analyzing replenishment curve in different MI levels.
Method: MCE was performed using Sequoia 512 (SIEMENS) during Definity® infusion in 7 dogs. Combination of the intermittent mode (1:1) and low MI (0.1 for all coronary vessels and 0.3 for arterioles) was applied to avoid the influence of cyclic variation or possible destruction of bubbles. The backscatter from bubbles in the ventricular septum was measured as dB and AU^2. The replenishment curve was fit to an exponential function: $y=A(1-e^{-\beta t})$. To correct the influence of acoustic field or attenuation, AU^2 at the septum(AU^2_M) and the adjacent part of LV cavity (AU^2_{LV}) were measured and the blood volume was calculated as $100\times AU^2_M/AU^2_{LV}$ (ml/100g).
Result: The blood volume of all coronary vessels (MI=0.1) measured by AU^2 was over 4 times higher than that of arterioles (MI=0.3) (2.91±1.06 vs. 0.63±0.10 ml/100g: p<0.005). However, A value at MI=0.1 measured by dB unit was not so significantly higher than that at MI=0.3 (17.7±4.08 vs. 15.9±4.22). The blood flow velocity presented as β value at arterioles level was significantly higher than that at capillary level (1.07±0.37 vs. 0.35±0.09: p<0.001) .
Conclusion: MCE reflects the blood flow and volume in each level of coronary arteries. At analyzing them quantitatively, the value may be varied depending on the unit. The blood flow velocity can be evaluated from the replenishment curve by using dB unit. The blood volume can be measured accurately by using AU^2 unit.

1017-162 Measurement of Compartment Blood Volume in the Myocardium: Myocardial Contrast Echocardiographic Study

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Background and Purpose: Recently, we reported a novel technique in which component of the coronary tree, such as capillaries or arterioles, could be visualized independently by myocardial contrast echocardiography (MCE). At quantification of ultrasonic backscatter from bubbles, square of acoustic unit (AU^2) is proven as proportional to bubble density. As for normalization of acoustic field, new skill has been proposed in which backscatter from bubbles is calibrated by that from the adjacent left ventricular (LV) cavity even at any acoustic power. Therefore, we hypothesized that the blood volume in capillaries and arterioles can be calculated independently by real time MCE.
Method: Real-time MCE was examined using Sequoia 512 (SIEMENS) during Definity® infusion in the short axis view of 17 dogs. Mechanical index (MI) was set at 0.1 and 0.3 for all vessel imaging and arteriole imaging, respectively. The end-diastolic image was used for analysis. Round region of interest having 8mm diameter was placed on the ventricular wall and the adjacent part of LV cavity, and AU^2 of the LV wall (AU^2_M) and cavity (AU^2_{LV}) were measured. The blood volume was calculated as $100\times AU^2_M/AU^2_{LV}$ (ml/100g) in each MI setting.
Result: At low MI, the myocardium was opacified homogeneously and the blood volume of whole vessels was calculated as 2.29±1.60 ml/100g. At relative high MI, thin and dotted echoes were demonstrated in the myocardium and the blood volume of arterioles was calculated as 0.27±0.32 ml/100g. Blood volume of capillaries was the subtracted one, which was approximately 90% of whole vessels.
Conclusion: Novel use of real-time MCE, which is alteration of MI and calibration by integrated backscatter of bubbles in the cavity, has a potential to calculate blood volume of each capillaries, arterioles etc, independently. It will throw light upon the physiology of intra-myocardial microcirculation.

1017-163 Quantitative Myocardial Contrast Echocardiography Is Useful to Evaluate Transmural Extent of Microvascular Damage in Patients With Myocardial Infarction

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Ischemic myocardial damage initially appears in subendocardium but the relationship between severity of subendocardial damage and wall motion abnormality remains unclear in MI patients. We developed a new calibration technique to quantitate microvascular integrity using myocardial contrast echocardiography (MCE). We aimed to establish quantitative relationship between subendocardial and subepicardial microvascular damage and wall motion abnormality.
Method: We performed triggered MCE with injection of Levovist and recorded end-systolic 1.5 harmonic (Toshiba) or ultraharmonic (Philips) images (4C view) in 24 patients with anterior MI. Relative myocardial contrast intensity (RMCI, dB) was calculated as the difference of contrast intensity of myocardium minus that of the adjacent LV cavity with VoluMap system. Ventricular septum was divided into 4 segments and RMCI was measured in RV half and LV half in each segment. From RMCI value, we estimated myocardial blood volume fraction (ml/100gmyo) of each segment, since the blood volume of LV cavity is 100 ml/100cc,
Results: RMCI decreased with worsening of asynergy both RV- and LV-halves. Estimated MBV in hypokinetic segments was about 50% of normal segments and MBV reduced to 25% of normals in akinetics.
Conclusion: It is the first clinical to quantitate transumural extent of microvasular damage in MI patients with MCE. RMCI provides an estimate of MBV, thatis determined by capillary volumes, and MBV reduces with worsening of wall motion abnormality.